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Mental Health and Educational Attainment: How Developmental Stage Matters

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Abstract

Developmental science suggests that the consequences of mental health problems for life-course outcomes may depend on the timing of their onset. This study investigated the extent to which mental health predicted educational attainment at age 17, 20, and 25, and whether gender moderated the links between mental health and educational attainment. It used data from Next Steps, a nationally representative panel survey of individuals born in 1989/1990 in England ($N = 15,594$, 48% female, 33% ethnic minority). The findings suggest that differences in mental health were more consequential for educational attainment during adolescence than in young adulthood. On average, girls attained higher levels of education than boys, but gender did not moderate the role that mental health played for educational attainment.

Public Significance Statement

This study suggests that educational attainment is more sensitive to good or bad mental health during adolescence than in young adulthood. This indicates a need to protect and promote mental health in particular among adolescents in order to empower them to achieve their academic potential. Findings also indicate that poor mental health is likely to impair the educational attainment of male and female adolescents in equal measure. Thus, mental health professionals should take warning signs of a mental illness in male and female adolescents equally seriously and should intervene in the same way where necessary.

Keywords: mental health; educational attainment; gender; life course; longitudinal; life-span developmental theory

Mental Health and Educational Attainment: How Developmental Stage Matters

Mental health is essential for how we feel, think, and behave. In educational contexts, good mental health is a prerequisite for learning and educational performance (Auerbach et al., 2016). It helps students to pay attention in class, cope with difficulties in school, and make important educational transitions (Evans et al., 2018; Mojtabai et al., 2015). Yet, mental health problems affect 10% to 20% of children and adolescents worldwide (Kieling et al., 2011; WHO, 2021). Poor mental health may disrupt educational trajectories and prompt early school leaving and low educational attainment (Mikkonen et al., 2018; Slmoninski et al., 2011).

However, the influence of mental health on educational outcomes may differ depending on the mental health domain concerned (Breslau et al., 2008; Hale et al., 2015; Leach & Butterworth, 2012). Moreover, there is controversy on whether mental health is equally consequential for educational outcomes at different points in an educational career. One possibility is that mental health problems may adversely influence educational attainment regardless of when these problems occur (McLeod & Fettes, 2007). The other possibility is that they might particularly affect educational outcomes if they occur comparatively early in life (Esch et al., 2014).

Indeed, based on life-span developmental and life-course theory, it would be reasonable to expect individuals' mental health status to be more predictive of educational attainment during adolescence than in young adulthood because adolescence is a dynamic maturational life phase that encompasses many developmental changes and challenges as well as potential turning points in human development (Dahl et al., 2018). Adolescents face a number of developmental tasks such as adapting to new social roles and responsibilities, developing greater autonomy in newly emerging developmental environments, or acquiring greater control over decision making and confidence in self-governance (Schulenberg et al., 2004; Steinberg & Silverberg, 1986). Adolescents must also acquire a range of new skills to transition to an increasingly independent adult role. Importantly, adolescence has also been viewed as a period of heightened "storm and stress" that is characterized by mood disruptions, risk behavior, and a tendency to experience conflict with adults (e.g., Arnett, 1999). According to this view, adolescents have a tendency to be more volatile emotionally than children or adults; they show more reckless, antisocial, and self-harming behavior (including risk behaviors such as smoking, drinking, and substance use; Dahl et al., 2018); and they tend to be rebellious and to resist adult authority, all of which might lead to difficulties in school (Eccles et al., 1993). As such, the trajectory from childhood to young adulthood involves a multitude of risks and, hence, adolescence is a period of vulnerability and opportunity. It also marks the start of the socioeconomic career (Staff & Mortimer, 2007). During this period, life-course trajectories increasingly start to diverge. For instance, whereas some adolescents continue in full-time education, others turn to more vocationally-oriented paths (Brunello & Rocco, 2017; Burger, 2021, 2023; Schoon & Lyons-Amos, 2016) or they combine schooling with paid work (Mortimer, 2010).

In conclusion, adolescence is a life-course marker, and experiences in adolescence may significantly deflect earlier behavioral and life-course trajectories (Johnson et al., 2011). That is, during adolescence, developmental trajectories relating to educational attainment processes might be particularly sensitive to good or bad mental health, especially because

adolescents are more likely than young adults to lack the skills to cope effectively with mental health issues (Skinner & Zimmer-Gembeck, 2007). In fact, from the perspective of selective optimization with compensation theory (Baltes, 1987; Baltes & Baltes, 1990), we may assume that the impact of mental health issues on educational attainment is more powerful among adolescents than among young adults because adolescents tend to have a more limited capacity to selectively optimize coping skills or otherwise compensate for a lack of such skills, merely as a result of their relative lack of experience. In sum, poor mental health during adolescence may be particularly disruptive and might lead to pivotal changes in educational trajectories.

Another debate concerns whether mental health predicts educational attainment similarly among young men and women (e.g., Riglin et al., 2013). Particularly noteworthy is the growing concern among policymakers and in media debates that girls' educational attainment could be hampered by mental ill-health more than boys' educational attainment (Stentiford et al., 2021). In fact, links between mental health and educational outcomes might vary by gender for various reasons—because girls and boys tend to experience substantially different types of mental health problems (Campbell et al., 2021), because there are gender-specific behaviors and responses to challenges in the educational domain (Eschenbeck et al., 2007), or because there are gender differences in how young people cope with common stressors and mental health problems (Wilhsson et al., 2017).

With this in mind, we analyzed whether distinct dimensions of mental health predicted critical educational attainments differentially at different stages in an educational career and whether there were gender differences in the associations between mental health and educational attainment. Specifically, we used data from a large-scale longitudinal study that followed a recent cohort of young people in England to examine the extent to which distinct dimensions of mental health predicted males' and females' probabilities of (a) continuing full-time education beyond age 16, (b) enrolling at university by age 20, and (c) obtaining a university degree by age 25. To the best of our knowledge, these questions have not been investigated previously.

Mental Health, Gender, and Educational Attainment at Various Developmental Stages

Mental health is the result of a complex interplay of environmental and social influences, neurodevelopmental, genetic, and psychological processes (Burger & Strassmann Rocha, in press). It refers to the capacity of emotion, thought, and behavior that enables individuals to realize their own potential relative to their developmental stages. Mental health thus reflects the resource and ability to effectively deal with and adapt to change and cope with environmental demands (Manwell et al., 2015; Vaillant, 2012; see also Patel et al., 2018). As such, mental health is thought to allow individuals to flourish and accomplish goals and priorities. Poor mental health, in contrast, is a manifestation of psychological, behavioral, or biological dysfunction that is associated with distress or disability in terms of an impairment human functioning (see, e.g., Stein et al., 2010). Consequently, (poor) mental health might play a significant role in educational attainment processes. Prior research has indeed revealed longitudinal associations between mental health and educational outcomes (Agnafors et al., 2021; O'Connor et al., 2019). Furthermore, research has indicated that these associations may differ by gender. This could be a consequence of gender-specific mental

health issues (Campbell et al., 2021; Rosenfield & Mouzon, 2013). Moreover, gender socialization theory has revealed gender-specific developmental challenges as well as gender-specific responses to such challenges (Eschenbeck et al., 2007; Priess et al., 2009). Finally, a different strand of research has found gender differences in coping with common stressors (Wilhsson et al., 2017), showing that girls tend to use problem-avoidant coping strategies and maladaptive regulating strategies more frequently than boys; girls also seem to exhibit greater vulnerability because of worse reactions to stressors (Rosenfield & Mouzon, 2013). This indicates that mental health issues could be more overwhelming and incapacitating for girls.

However, findings in this respect have been inconsistent so far, preventing us from reaching any general conclusions (Hampel & Petermann, 2006; Seiffge-Krenke et al., 2009). Researchers in various countries have investigated whether there are gender-specific links between mental health and educational attainment and have presented inconclusive findings to date. Some studies suggest that female adolescents' educational attainment might be hampered by poor mental health more than male adolescents' educational attainment (Cornaglia et al., 2015; Fletcher, 2008; Needham, 2009; Veldman et al., 2014). However, other studies have not provided any evidence of a specific female disadvantage. Instead, these studies suggested that adolescent mental health problems have deleterious effects on later educational outcomes in both genders (Brännlund et al., 2017; Deighton et al., 2018; Hjorth et al., 2016; Smith et al., 2021; von Simson et al., 2022). Thus, studies focusing on gender differences in the association between mental health and educational attainment have found discrepant results (Esch et al., 2014; Wickersham et al., 2021).

One reason for the inconclusive evidence regarding gender-typical links between mental health and educational outcomes might be that the studies used differing conceptualizations of mental health; moreover, some did not distinguish between different dimensions of mental health and instead used a single factor to represent various facets of mental health in one score. Another reason is that gender and mental health could interact differentially at different points in an individual's educational career. This means that the various dimensions of mental health might relate differentially to educational outcomes at different time points, either for both sexes or just for a given sex. One reason why this might occur is that some mental health problems change over time (Kessler et al., 2005; Petersen et al., 2022). For instance, self-esteem typically decreases in early adolescence, particularly among female adolescents, although there is considerable interindividual variability (e.g., Robins & Trzesniewski, 2005). Moreover, adolescents of both sexes enjoy slightly higher wellbeing on average than (young) adults (Blanchflower, 2020). Taken together, such findings suggest that it is important to examine whether different dimensions of mental health are related to subsequent educational attainment in distinct ways (among both sexes or just one given sex), and whether the strength of the links between poor mental health and educational attainment depends on the time point at which an individual exhibits poor mental health. Importantly, developmental science suggests that the timing of specific experiences may influence developmental outcomes (Fox et al., 2010; see also Gutman et al., 2019). The implication of this is that associations between mental health and various life-course outcomes may vary across the life course (Leach & Butterworth, 2012). Against this background, we aimed to assess whether distinct dimensions of mental health predict critical educational attainments differentially at different stages of an educational career, and whether

there are gender differences in the links between mental health and these educational attainments.

Dimensions of Mental Health

Based on the literature about stress (Lazarus, 2006) and self-system processes (Connell & Wellborn, 1992; Zimmer-Gembeck, 2016), we distinguished between distinct components of mental health which are related to environmental demands (stress) on the one hand and self-appraisals (self-esteem and depressive symptomatology) on the other.[1] Each of these components of mental health is relevant for psychological functioning and might equally be relevant for educational attainment.

Self-Esteem

Self-esteem is a self-evaluative trait, reflecting a person's overall appraisal of their self-worth (Orth et al., 2012). Individuals with high self-esteem generally feel good about and like themselves; they have a positive attitude toward and have respect for themselves (Robins & Trzesniewski, 2005). Self-esteem has been found to predict school achievement in adolescence (Burger et al., 2020). At the same time, research suggested that the links between self-esteem and later life outcomes, including educational attainment (Marsh & O'Mara, 2008), are often weak and potentially even inconsequential (Baumeister et al., 2003; Boden et al., 2008). One reason for the inconclusive evidence stemming from studies on the predictive power of self-esteem could be that self-esteem might have different consequences on later outcomes at different points in development. Thus, it is crucial to examine whether the implications of self-esteem for educational attainment depend on the educational career stage that individuals are in.

Depressive Symptomatology

Depressive symptomatology is the combination of symptoms that categorize depression, encompassing low mood and loss of pleasure in day-to-day activities that are beyond the negative affect that an individual would typically experience (Ayuso-Mateos, 2010; Hoare et al., 2016). Individuals with depressive symptomatology appraise their lives negatively and they feel unhappy and psychologically unhealthy. Depressive symptomatology is associated with a wide range of difficulties and impaired psychosocial functioning, including anxiety, pessimism and a perceived lack of control, substance use disorders, negative attributional style, dysfunctional attitudes and behaviors, indecisiveness, and a decreased ability to self-monitor and self-evaluate (Garber et al., 1993; Gotlib et al., 1995; Hops et al., 1990; Salmela-Aro et al., 2008). Young people with depressive symptoms also display lower levels of mental wellbeing (Zadow et al., 2017); they consider their lives less worthwhile and meaningful. Inasmuch as they doubt that their lives are going well, they will likely be less action-oriented and display fewer behaviors that would otherwise allow them to achieve success in various domains. Depressive symptomatology thus creates conditions that prevent positive human potential, motivation, and persistence, hampering performance and

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[1] We do not claim that depressive symptomatology exclusively reflects negative self-appraisals but note that such self-appraisals are a hallmark of depressive symptomatology (Hards, Ellis, Fisk, & Reynolds, 2020; Jones & Day, 2008; Porter, Zelkowitz, Gist, & Cole, 2019).

potentially educational attainment as well (Berndt et al., 2000; Fletcher 2010, Olivier et al., 2023).

Perceived Stress

Stress may refer to a stimulus or a response to a stimulus. Here, we focus on an individual's negative psychological response to a stimulus (or stressor), that is, perceived stress. Such a response may occur when environmental demands exceed an individual's resources for coping and/or their response capability (e.g., Lazarus, 2006). It can include a variety of emotional and cognitive states, such as anxiety, sorrow, lack of concentration, the sense of being overwhelmed, helplessness, or insomnia (Folkman, 2013). However, in addition to the negative outcomes of perceived stress, there may be positive outcomes, such as positive personal changes, stress-related growth (Ord et al., 2020), and reinterpretations of situations. This means that individuals who undergo stressful life events may derive some positive benefit from the experience if it is not overpowering (Bower et al., 2008). In the educational domain, perceived school-related stress has been found to predict decreased educational performance (Gustems-Carnicer et al., 2019; Rothon et al., 2009; Suldo et al., 2009). Particularly stressful life events may also lead to early school leaving (Dupéré et al., 2018), resulting in truncated educational careers. However, it is unclear whether perceived stress is equally consequential for educational outcomes in different phases of an educational career.

Study Aims and Hypotheses

Adopting a developmental science perspective, we asked whether mental health had differential predictive power for educational attainment at different time points. Specifically, we examined the extent to which different dimensions of mental health (self-esteem, depressive symptomatology, and perceived stress) predicted individuals' probabilities of continuing in full-time education beyond age 16, of enrolling at university by age 20, and of obtaining a university degree by age 25.

We assumed that mental health would be more predictive of educational attainment during adolescence than in young adulthood. This is because adolescence is a dynamic maturational life phase in which various developmental changes and foundational learning experiences take place. Hence, it is a time when young people's lives can change quickly, in both positive and negative directions (Dahl et al., 2018). Accordingly, developmental trajectories relating to educational attainment processes might be particularly affected by individuals' mental health status. Poor mental health may push individuals beyond their ability to cope, especially during adolescence, thereby disrupting normal functioning and leading to poor psychological and behavioral responses that may undermine educational performance (Burger & Samuel, 2017; Lazarus, 2006; Vaez & Laflamme, 2008). In contrast, in young adulthood, people often have better coping mechanisms (Skinner & Zimmer-Gembeck, 2007). Hence, young adults might be in a better position than adolescents when it comes to dealing with poor mental health and their coping capacities might minimize any potential influences of poor mental health on educational attainment.

Moreover, links between mental health and educational outcomes might vary by gender, and gender and mental health might interact differentially at distinct points in an

individual's educational trajectory. Gender could moderate the influence of mental health on critical educational attainments because of gender differences in mental health problems, developmental challenges, and coping mechanism (Campbell et al., 2021; Hampel & Petermann, 2006; Priess et al., 2009). Against this background, we tested three hypotheses.

Hypothesis 1: Distinct dimensions of mental health differentially predict educational attainment.

Hypothesis 2: Mental health is more predictive of educational attainment in adolescence than in young adulthood.

Hypothesis 3: Links between mental health and educational attainment differ by gender.

To test these hypotheses, we used longitudinal data from a nationally representative study that followed young people from age 13/14 to age 25/26 in England. We estimated logistic regression models to predict educational attainment in different life phases and expressed the findings as odds ratios and as predicted probabilities. This allowed us to gauge the predictive power of different dimensions of adolescent and young adult mental health for three critical educational attainments (continuing in full-time education beyond age 16, enrolling at university by age 20, and attaining a university degree by age 25).

Method

Sample

We used data from Next Steps, formerly known as the Longitudinal Study of Young People in England (LSYPE), a nationally representative panel survey of 15,770 individuals born between September 1989 and August 1990 that was drawn from 647 schools in England (UCL, IoE, CLS, 2021). LSYPE used a two-stage stratified sampling procedure. The primary sampling units were schools; these were stratified by deprivation status as measured by the proportion of pupils in a school who received free school meals. The secondary sampling units were students, with student selection probabilities being dependent on ethnic group membership as recorded in the Pupil Level Annual Schools Census. Deprived areas and ethnic minorities were oversampled in the study. We applied survey weights to adjust for the complex sampling structure and differential selection probabilities (see Analytic Strategy). The panel survey began in 2004, when the respondents were between 13 and 14 years of age. Face-to-face interviews were carried out annually with the participants and their parents from 2004 to 2010, and a follow-up wave was conducted in 2015–16, when the participants were aged 25/26. The initial response rate was 74% (in wave 1), with annual attrition rates varying between 8% and 14% (DfE, 2011). The analytic sample used here included 15,594 individuals in wave 1 (2004). Given attrition, the sample included 7,569 individuals in the last wave (wave 8, 2015-16). Relative to the original sample in wave 1, the sample in wave 8 included a greater proportion of female respondents (54% vs. 48%), a slightly smaller proportion of ethnic minorities (31% vs. 33%), respondents with almost identical academic performance levels ($M = 27.0$, $SD = 4.3$ vs. $M = 26.4$, $SD = 4.4$), respondents whose parental educational background was slightly higher ($M = 4.0$, $SD = 2.0$ vs. $M = 3.8$, $SD = 2.0$), respondents whose parental social class was slightly higher (42% higher social class, 33% intermediate social class, 25% lower social class vs. 38% higher social class, 34% intermediate social

class, 28% lower social class), and respondents whose household income was slightly higher (M = 3.2, SD = 1.4 vs. M = 3.0, SD = 1.4).

Measures

We describe all measures hereafter. Table 1 reports descriptive statistics; Table 2 provides the zero-order correlations among all variables.

Educational Attainment

We used three assessments of educational attainment. Specifically, we measured (a) whether respondents continued education beyond age 16 (assessed in wave 5, 2008); (b) whether they had enrolled at university by age 20 (assessed in wave 7, 2010); and (c) whether they had obtained a university degree by age 25/26 (assessed in wave 8, 2015–16).

Dimensions of Mental Health

To assess distinct dimensions of mental health, we used the General Health Questionnaire (GHQ-12), which provides a self-reported measure of mental health among respondents in community settings and nonpsychiatric clinical settings (Goldberg & Williams, 1988). The GHQ-12 is a shortened version of a longer health questionnaire (originally consisting of 60 items) by the World Health Organization. The GHQ-12 is popular because of its brevity and it has been extensively used in psychological, epidemiological, econometric, and other social research, enabling comparisons across studies (see Gnambs & Staufenbiel, 2018, for a review). The questionnaire includes twelve statements about mood states or symptoms that relate to multiple health dimensions (Nouri et al., 2021; Sánchez-López & Dresch, 2008). Respondents indicate the extent to which they recently experienced a given mood state or symptom. We used data about respondents' mental health from waves 4 and 8 (see Analytic Strategy for details). While the GHQ-12 questionnaire may be used to capture mental health in one sum score, research has established its multidimensional nature. Using different samples in different contexts as well as different methodologies, researchers have found diverging evidence regarding the factor structure, however. In fact, empirical evidence exists that supports two-, three-, and four-factor structures (e.g., Griffith & Jones, 2019; Hystad & Johnsen, 2020; Padrón et al., 2012; Shevlin & Adamson, 2005). Researchers have used a range of different labels for these factors, including self-esteem, self-worth, loss of confidence, stress, wellbeing, successful coping, emotional coping, social performance, social dysfunction, unhappiness/anhedonia, dysphoria, and the like (e.g., Doi & Minowa, 2003; French & Tait, 2004; Graetz, 1991; Martin, 1999; Politi et al., 1994; Rey et al., 2014; Shevlin & Adamson, 2005; Taylor, 2006; Worsley & Gribbin, 1977). Based on a review of prior research, we distinguished the following – frequently observed, albeit variously termed – dimensions: self-esteem, depressive symptomatology, perceived stress, and social functioning (e.g., Griffith & Jones, 2019). However, because we needed constructs that exhibit both sufficient reliability and longitudinal measurement invariance, we excluded the social functioning factor, which did not meet our inclusion criteria in this respect. We thus retained three dimensions: self-esteem, depressive symptomatology, and perceived stress (these are all directly indicative of mental health). Where necessary, we reverse coded items so that higher

values reflected higher levels of self-esteem, depressive symptomatology, and perceived stress, respectively.

Self-Esteem. Three items were used to assess self-esteem. Using a 4-point rating scale, respondents assessed (1) *whether they had recently felt that they were playing a useful part in things* (1 = much less useful than usual, 2 = less useful than usual, 3 = same as usual, 4 = more so than usual), (2) *how much they had been losing confidence in themselves recently* (1 = much more so than usual, 2 = rather more than usual, 3 = no more than usual, 4 = not at all), and (3) *how much they had been thinking of themselves as a worthless person recently* (1 = much more than usual, 2 = rather more than usual, 3 = no more than usual, 4 = not at all). McDonald's omega was .75 (in wave 4) and .79 (in wave 8).

Depressive Symptomatology. Three items were used to assess depressive symptomatology. Using a 4-point rating scale, respondents assessed (1) *how much they had been able to enjoy normal day-to-day activities recently* (1 = much more than usual, 2= rather more than usual, 3 = no more than usual, 4 = not at all), (2) *how much they had been feeling unhappy and depressed recently* (1 = not at all, 2 = no more than usual, 3 = rather more than usual, 4 = much more than usual), and (3) *whether they had been feeling reasonably happy recently, all things considered* (1 = much more than usual, 2 = rather more than usual, 3 = no more than usual, 4 = not at all). McDonald's omega was .67 (in wave 4) and .76 (in wave 8).

Perceived Stress. Three items were used to assess perceived stress. Using a 4-point rating scale, respondents assessed (1) *whether they had been able to concentrate on whatever they were doing recently* (1 = better than usual, 2 = same as usual, 3 = less than usual, 4 = much less than usual), (2) *whether they had lost sleep over worry recently* (1 = not at all, 2 = no more than usual, 3 = rather more than usual, 4 = much more than usual), and (3) *whether they had felt constantly under strain recently* (1 = not at all, 2 = no more than usual, 3 = rather more than usual, 4 = much more than usual). McDonald's omega was .70 (in wave 4) and .73 (in wave 8).

Covariates

Gender was assessed with a binary variable (0 = male, 1 = female). *Parental social class* was assessed in wave 1, using the National Statistics Socio-Economic Classification (NS-SEC). We distinguished three categories in accordance with the instructions provided by the Office for National Statistics (2021): (1) routine and manual occupations (lower social class), (2) intermediate occupations (intermediate social class), and (3) higher managerial, administrative and professional occupations (higher social class). We used the score of the parent with the higher class level. *Gross household income* was reported by parents on an ordinal scale that included 33 categories, ranging from no income to 36,400 GBP or more (we divided the distribution into approximate quintiles: 1 = < 10,400, 2 = 10,400–15,600, 3 = 15,600–26,000, 4 = 26,000–36,400, 5 = > 36,400). *Parental education* was assessed using parents' highest qualification (1 = no qualification, 2 = other qualifications, 3 = qualifications at level 1 and below, 4 = GCSE grades A–C or equivalent, 5 = GCE A level or equivalent, 6 = higher education below degree level, 7 = degree or equivalent). We used the score of the

parent with the higher educational qualification. *Academic performance* was assessed using the mean of the test scores in math and English from national curriculum tests at the end of key stage 2, at age 11. *Ethnic minority* was assessed using a binary variable (0 = white, 1 = other). Given the ethnic diversity in England, there were too many ethnic groups to analyze group differences in our models.

Data Analyses
Missing Data

Like many other panel surveys, Next Steps has missing data due to item nonresponse and panel attrition. Table 1 summarizes the number of observations with valid data for the respective panel waves. The percentage of missing data due to item nonresponse on the study variables varied between 0% and 26.3%, but it was no more than 5.3% on average across items. Missing values can limit the generalizability of the findings. To adjust parameter estimation in light of missing data, we used full information maximum likelihood (FIML) estimation, as implemented in Mplus (Muthén & Muthén, 2017). FIML estimation uses all available raw data and does not discard any values. It is based on the assumption that missing values on a given variable are conditionally dependent on other observed variables in the data; incorporating vectors of partially complete data in the likelihood functions implies probable values for the missing data in the estimation procedure (Enders & Bandalos, 2001). Like missing data imputation techniques, FIML has been widely used as it yields more efficient estimates and diminishes the risk of biased estimation relative to traditional methods of dealing with missing values such as pairwise or listwise deletion of cases (Enders, 2010; Little et al., 2014).

Analytic Strategy

We sought to assess proximal longitudinal associations between mental health and educational attainments, estimating logistic regressions to predict individuals' probabilities of (a) continuing full-time education beyond age 16, (b) enrolling at university by age 20, and (c) obtaining a university degree by age 25. Specifically, we used data about respondents' mental health collected in wave 4 (year 2007), to predict whether respondents continued full-time education one year later (year 2008), and whether they enrolled at university three years later (in 2010). We further used data about mental health collected at age 25, in wave 8 (year 2015), to assess links between mental health and university degree attainment at age 25. Unfortunately, Next Steps did not collect data about mental health in other waves that would have allowed us to assess proximal longitudinal associations between mental health and university degree attainment at age 25. However, in a supplementary analysis, we also used data about mental health from wave 4 (year 2007) to estimate individuals' probabilities of obtaining a university degree at age 25 (year 2015) as a function of their adolescent (rather than young adult) mental health. We thereby also took into account that some students obtained their degree before age 25. To assess whether links between mental health and educational attainment differ by gender, we estimated interaction effects. Moreover, we also calculated predicted probabilities separately for each gender, estimating how these probabilities vary across the range of values of the mental health variables. We calculated these predicted probabilities because interaction effects in nonlinear (logistic) models cannot

be evaluated simply by examining the sign, magnitude, or significance of the coefficient (Ai & Norton, 2003) as this coefficient is not necessarily informative (Mize, 2019). In addition, we replicated all analyses using linear probability models as robustness tests. We controlled for ethnicity, academic performance at age 11, parental education, parental social class, and parental income. Note also that we initially established that the mental health variables were understood and measured equivalently over time, testing for longitudinal measurement invariance. Supplemental Material A reports the findings from these tests, showing that the mental health variables were invariant over time.

We considered the complex sampling structure, applying survey weights (design weight, sample weight, and stratum weight) to correct for differential selection probabilities (Calderwood, 2018; DfE, 2011). We estimated cluster and heteroskedasticity robust standard errors using Monte Carlo integration (Muthén & Muthén, 2017). The models yielded maximum likelihood parameter estimates that are robust to nonnormality and nonindependence of observations. They produced average marginal effects reflecting the conditional average change in the odds of an outcome associated with a 1-unit increase in a given predictor. Moreover, we expressed the results as predicted probabilities and visualized these probabilities using graphical representations, which makes it easier to interpret the coefficient estimates and also provides a measure of effect sizes (or practical significance of the findings).

Transparency and Openness

We followed state-of-the-art journal article reporting standards (Kazak, 2018), explaining how we determined the appropriate sample size, all data exclusions, all manipulations, and all measures in the study. The study used data that are available to users registered with the UK Data Service (doi.org/10.5255/UKDA-SN-5545-7). Materials and analysis code for this study are available from the corresponding author. Data were analyzed using Mplus, version 8.6 (Muthén & Muthén, 2017). Graphs were created using *R*, version 4.0.2 (R Core Team, 2020), and the packages *ggplot2*, version 3.3.3 (Wickham, 2016), *ggeffects*, version 1.1.0 (Lüdecke, 2018), *sjmisc*, version 2.8.7 (Lüdecke, Giné-Vázquez, et al., 2021), *sjlabelled*, version 1.1.8 (Lüdecke, Ranzolin, et al., 2021), and *gridExtra*, version 2.3 (Auguie & Antonov, 2017). The study's design and its analyses were not preregistered.

Results

Descriptive Statistics

Table 1 shows the descriptive statistics for all variables. Here, we will discuss the descriptive statistics of the key study variables. Regarding educational attainment, we noted that among the respondents included in the sample, 79% continued education beyond age 16 in 2008, 49% were enrolled at university by age 20 in 2010, and 35% had obtained a degree by age 25 in 2015–16. Regarding mental health, respondents reported moderate to high levels of self-esteem ($M = 3.31$) and moderate to low levels of depressive symptomatology ($M = 1.92$) and perceived stress ($M = 2.02$) in 2007, when they were 16/17 years old. On average, levels of self-esteem decreased slightly from wave 4 (at age 16/17) to wave 8 (at age 25/26). The results of a one-way repeated measures analysis of variance (ANOVA) revealed that this decrease between the two time points was significant (Wilks' Lambda = .99, $F(1, 6180) =$

69.59, $p < .001$). In contrast, levels of depressive symptomatology and perceived stress increased slightly but significantly from wave 4 to wave 8 (Wilks' Lambda = .99, $F(1, 6179)$ = 69.30, $p < .001$, and Wilks' Lambda = .99, $F(1, 6185)$ = 70.03, $p < .001$, respectively). Supplemental Material Table B.1 reports descriptive statistics for the entire sample and for the subsamples of female and male respondents.

How Distinct Dimensions of Mental Health Predicted Educational Attainment

Table 3 reports odds ratios from the logistic regressions predicting educational attainment as a function of all study variables, including interactions between gender and mental health indicators. The results provide partial support for Hypothesis 1, which posits that distinct dimensions of mental health differentially predict educational attainment. Model 1 shows that adolescents' depressive symptomatology and perceived stress, but not their self-esteem, significantly predicted whether they continued education beyond age 16 (OR = 0.70, 95% CI [0.56, 0.88], $p < .01$, and OR = 1.33, 95% CI [1.08, 1.65], $p < .01$, respectively). Model 2 shows that adolescents' perceived stress, but neither self-esteem nor depressive symptomatology, significantly predicted whether they enrolled at university by age 20 (OR = 1.42, 95% CI [1.14, 1.75], $p < .01$). Finally, Model 3 shows that young adults' mental health was not significantly associated with their probability of obtaining a university degree by age 25. Thus, distinct educational attainments were differentially sensitive to the indicators of mental health under investigation.

Mental Health and Educational Attainment at Different Developmental Stages

The results partially confirm Hypothesis 2 that mental health is more predictive of educational attainment in adolescence than in young adulthood (Table 3). Adolescents' depressive symptomatology and perceived stress significantly predicted their probability of continuing education beyond age 16 (see Model 1: OR = 0.70, 95% CI [0.56, 0.88], $p < .01$, and OR = 1.33, 95% CI [1.08, 1.65], $p < .01$, respectively), and adolescents' perceived stress significantly predicted their probability of enrolling at university by age 20 (Model 2: OR = 1.42, 95% CI [1.14, 1.75], $p < .01$). However, none of the indicators of young adults' mental health was significantly related to the probability of obtaining a university degree by age 25 (Model 3).

Figures 1 to 3 visualize these results, illustrating the extent to which educational attainment probabilities varied as a function of indicators of mental health (and gender). These figures allow us to interpret the results in more substantive terms and to appraise the magnitude of effects. To clarify one example, consider Figure 2, which reports the predicted probabilities of educational attainments at age 17, 20, and 25 as a function of depressive symptomatology and gender. On average, individuals were estimated to have a 79% predicted probability of continuing in education beyond age 16 (left panel). However, that probability ranged between 82% and 71% for male respondents and between 88% and 79% for female respondents depending on their adolescent depressive symptomatology (adolescents with greater depressive symptomatology were less likely to continue in education beyond age 16). Similarly, the probability of enrolling at university by age 20 was sensitive to individuals' adolescent depressive symptomatology, varying between 39% and 34% among male respondents and between 47% and 42% among female respondents (middle panel). In

contrast, young adults' depressive symptomatology was statistically unrelated to the probability of obtaining a university degree by age 25 (right panel).

We performed sensitivity analyses to test the robustness of these findings, re-estimating our models using two alternative specifications for each model. First, we included each indicator of mental health separately in the model (as main effect) but did not examine the interaction of that indicator with gender. Second, we included the three indicators of mental health jointly (as main effects) but did not examine the interactions of those indicators with gender. These sensitivity analyses provided additional evidence in support of Hypothesis 2, confirming the conclusion that the dimensions of mental health we investigated were more predictive of educational attainment in adolescence than in young adulthood (results available on request).

In a supplementary analysis, we also estimated individuals' probabilities of obtaining a university degree as a function of their adolescent (rather than young adult) mental health (Model 4 in Table 3). We found that adolescent-perceived stress was significantly positively related to the probability of obtaining a university degree (OR = 1.33, 95% CI [1.03, 1.72], p < .05), whereas adolescent self-esteem and depressive symptomatology were statistically unrelated to that probability. These findings provide further evidence that a specific dimension of adolescent mental health (perceived stress) predicted later attainment more powerfully than young adult-mental health predicted attainment.

Mental Health and Educational Attainment: Considering the Role of Gender

Although we found gender differences in mental health levels (Table 2 and Supplemental Material Table B.1), we did not find any empirical evidence of gender differences in links between mental health and educational attainment; all interactions were statistically nonsignificant (see Models 1 to 4 in Table 3). The nonsignificant interactions from our main models (Models 1 to 3) are plotted in Figures 1 to 3 (solid lines for male respondents, dashed lines for female respondents). The solid and dashed lines are largely parallel throughout, indicating that gender did not significantly moderate the links between mental health and educational attainment. Note that these findings were entirely confirmed when using linear probability models, which we estimated as robustness tests (see Supplemental Material Table C.1). Given these findings, we did not observe support for Hypothesis 3 that the links between mental health and educational attainment differ by gender.

Discussion

We investigated whether distinct dimensions of mental health differentially predicted key attainments at different points in an educational career and whether gender moderated any potential effects of mental health on educational attainment. We used data from a nationally representative large-scale longitudinal study from England to test three hypotheses—namely that distinct dimensions of mental health differentially predict educational attainment (Hypothesis 1), that mental health is more predictive of educational attainment in adolescence than in young adulthood (Hypothesis 2), and that the links between mental health and educational attainment differ by gender (Hypothesis 3).

Distinct Dimensions of Mental Health Differentially Predicted Educational Attainment

Findings from logistic regressions predicting key educational attainments at three different points in an educational career partially supported Hypothesis 1. Higher levels of adolescent-perceived stress predicted a higher probability of continuing in full-time education beyond age 16, greater adolescent depressive symptomatology predicted a lower probability of continuing in full-time education beyond age 16, and adolescent-perceived stress predicted a higher probability of enrolling in university by age 20. However, adolescent self-esteem was unrelated to these educational attainments. Hence, different dimensions of adolescent mental health were differentially predictive of educational attainment. While this pattern of results contradicts assumptions that different mental health domains would influence educational attainment in a homogenous way (Cornaglia et al., 2015), it is in line with evidence suggesting that educational attainments are differentially sensitive to distinct facets of psychological functioning (Burger et al., 2020; Riglin et al., 2013; Veldman et al., 2014).

Adolescent depressive symptomatology is seemingly not only an indicator of negative affect and thought but also apparently prevents adolescents from performing and achieving good outcomes in education. This finding supports prior research, indicating that depressive symptomatology may substantially minimize human functioning and have potentially severe repercussions for educational attainment processes (Fletcher, 2010). Thus, the ability of young people to pursue full-time education beyond compulsory schooling seems to be hampered in part by depressive symptomatology (see also Berndt et al., 2000).

Interestingly, adolescents who reported higher levels of perceived stress were more likely to continue in full-time education beyond age 16 and to enroll at university by age 20. This is at odds with some prior research providing evidence of a negative influence of perceived stress on educational performance (Rothon et al., 2009; Vaez & Laflamme, 2008) but might potentially be interpreted as a result of stress-related growth (Ord et al., 2020). The demands associated with school and school curricula are among the most commonly reported sources of stress for young people (Burger & Samuel, 2017; Kieling et al., 2011). Students who take education very seriously and are highly engaged may also be more likely to experience heightened levels of stress while still performing well. Indeed, there is evidence from other studies suggesting that students with high aspirations have high standards that trigger stress (Låftman et al., 2013). Likewise, young people who follow academically-oriented educational pathways experience more stress at school than those on vocational pathways (Salmela-Aro et al., 2008). Hence, students who aim to continue in full-time education and to enroll at university by age 20 likely experience elevated levels of stress associated with the academic demands they are facing (Suldo et al., 2009). In terms of their educational performance, they might even benefit from these elevated levels of stress, because they might find stress stimulating and hence perceptions of stress might trigger motivation (cf., Bower et al., 2008; Lazarus, 2006).

Importantly, we found that self-esteem was not uniquely related to educational attainment when controlling for other mental health indicators and further covariates, either in adolescence or in young adulthood. This finding is in line with claims that self-esteem does not improve later life-course outcomes such as educational attainment (Marsh & O'Mara, 2008) as well as with evidence suggesting that longitudinal associations between self-esteem and later outcomes are often negligible (Baumeister et al., 2003; Boden et al., 2008). Thus,

although self-esteem may cause some positive outcomes, such as facilitating persistence after failure (Di Paula & Campbell, 2002), in this study, we did not find empirical support for the idea that self-esteem promotes attainment.

Taken together, our findings regarding Hypothesis 1 imply that mental health is best understood as a multidimensional construct and that distinct dimensions of mental health are not uniformly related to individual attainments. By extension, this also signifies that mental health may involve imperfect human functioning in certain domains without necessarily impairing individuals' capacity to achieve their full potential. We all occasionally experience aversive affective states, have negative thoughts, and function less well than usually in certain domains (Burger & Strassmann Rocha, in press). Such experiences do not systematically harm longer-term educational trajectories although they can jeopardize individuals' functional adaptation in the face of challenges and risks.

Mental Health Was More Predictive of Educational Attainment in Adolescence Than in Young Adulthood

Our findings also partially confirm Hypothesis 2, which posited that mental health would be more predictive of educational attainment in adolescence than in young adulthood. Perceived stress and depressive symptomatology in adolescence significantly predicted the probability of continuing in education beyond age 16, and perceived stress in adolescence significantly predicted the probability of enrolling at university by age 20 and of attaining a degree by age 25. In contrast, none of the dimensions of young adults' mental health examined here was related to university-degree attainment by age 25 when controlling for sociodemographic and individual background. Hence, differences in adolescent mental health seemed to be more consequential for educational attainment than differences in in young adult mental health. Adolescence is a dynamic phase in which multiple developmental changes take place (Dahl et al., 2018). Hence, developmental trajectories relating to educational attainment processes might be more easily influenced by good or bad mental health during adolescence than in young adulthood—a point at which most people have acquired a greater range of skills and better coping mechanisms (Skinner & Zimmer-Gembeck, 2007). Young adults' coping strategies may in fact result in better psychological and behavioral responses to environmental demands and less disruption in terms of educational performance. These strategies might counteract any adverse effects of situations that young adults appraise as endangering their normal functioning (cf., Seiffge-Krenke et al., 2009). Relative to adolescents, young adults might therefore be more resilient when confronted with (emotional) stressors, and hence their educational performance may be more constant even in the face of adversity (Bartley et al., 2010). With this in mind, we advocate that mental health interventions and treatments be adapted appropriately to the specific mental health needs of adolescents and young adults. Importantly, mental health services embedded within compulsory (secondary) school systems may be more effective at promoting mental health and educational attainment among young people than mental health interventions that target young adults later in life. Although as a society we must prioritize mental health among all age groups, programs designed to attend to adolescent mental health might disproportionately benefit both individuals and society.

Links Between Mental Health and Educational Attainment Did Not Differ by Gender

Finally, our findings did not provide any support for Hypothesis 3, which proposed that the links between mental health and educational attainment would differ by gender. Although some prior studies have identified gender differences in the effects of various facets of mental health on educational outcomes (Cornaglia et al., 2015; Fletcher, 2008; Needham, 2009; Veldman et al., 2014), gender does not seem to universally moderate the effects of mental health on key educational attainments. This finding aligns with evidence from prior studies that did not find systematic gender differences in the associations between mental health and educational outcomes (Esch et al., 2014; von Simson et al., 2022; Wickersham et al., 2021) and it underlines the importance of mental health for educational outcomes for both sexes (Brännlund et al., 2017; Deighton et al., 2018; Hjorth et al., 2016). It also challenges assumptions and narratives about gender-specific capacities or strategies to cope with mental health problems (Hampel & Petermann, 2006; Rosenfield & Mouzon, 2013). If at all, poor mental health is likely to impair educational attainment processes of male and female adolescents and young adults in equal measure. Thus, mental health professionals should take warning signs of a mental illness in male and female adolescents equally seriously and should intervene in the same way where necessary.

Strengths and Limitations

This is the first study to explore the differential predictive power of distinct dimensions of mental health for key educational attainments at three critical stages of an individuals' educational career. However, the study has some noteworthy limitations.

With regard to the measurement of mental health, we note that we examined only some dimensions of mental health. We have not, for instance, explored mental health problems in terms of externalizing or internalizing symptoms, anxiety, or substance use disorders, although they are potentially relevant to academic attainment as well. Moreover, we focused on mental health and mental health impairments at subclinical levels rather than psychiatric disorders, which may undermine educational performance more dramatically (Breslau et al., 2008). It is also important to note that the GHQ-12 measures current symptomatology, rather than a stable tendency to experience mental health issues over longer time periods, which might have more severe implications for educational attainment processes. Future research should investigate the potential short- and long-term repercussions of persistent mental illnesses on educational attainment. Finally, we recognize that our measures of mental health had acceptable, but not very high internal consistency. Future research should ideally use more elaborate measures.

Regarding the study design, we note that the intervals between the measurement points for predictors and outcomes were not identical for each educational attainment, and young adult mental health and university degree attainment were measured contemporaneously (at wave 8). The associations we found may therefore be partly subject to variation in the intervals between measurement points. However, despite being measured contemporaneously, none of the associations between indicators of young adult mental health and university degree attainment was significant in the regression models, whereas multiple associations between indicators of adolescent mental health and subsequent educational attainments were significant (see Table 3), although adolescent mental health and those educational attainments were measured up to ten years apart. Furthermore, we did not have access to a measurement

of mental health at age 20, which would have been desirable. We look to future research in other contexts to address that gap in the literature.

Moreover, although we used longitudinal data from a nationally representative sample and controlled for observable potential confounders in order to compare individuals with different mental health levels at various stages in their educational career, this study does not allow us to interpret the findings as causal effects. It was challenging for our study, like many others in the field, to distinguish between cause and effect, because the links between mental health and educational outcomes might be reciprocal. We thus used a longitudinal design to show that important aspects of mental health (differentially) preceded educational attainments at different stages of an educational career.

Finally, the study was based on a sample that is representative of a recent cohort in England; its naturalistic longitudinal design allowed us to study mental health and educational attainments under real-world conditions. However, because human development cannot be separated from its environmental context, the study's findings may not necessarily generalize to other countries or other cohorts without further assumptions, as mental health levels, education systems, and educational careers may be quite different.

Based on developmental science theory, we assumed that individuals' mental health would be more consequential for educational attainment during adolescence than in young adulthood, because adolescence involves many developmental changes and challenges, but also represents a period during which young people may still lack the skills to cope effectively with adversity. This study supports this assumption, showing that variation in specific dimensions of adolescent mental health significantly predicted later educational attainments, whereas among young adults, mental health was unrelated to educational attainment. These findings did not vary by gender. Hence, this study indicates a particular need to protect and foster adolescents' mental health to enable them to develop their academic abilities to their fullest potential. Adolescence is a period of opportunity and vulnerability that seems to incorporate various potential turning points in educational attainment processes. Adolescents need to master a variety of developmental tasks, such as adapting to new social roles and assuming new responsibilities, in order to transition to an increasingly independent young adult role. During this period, mental health issues seem to constitute a risk factor for poor educational attainment. Against this background, mental health interventions and treatments during compulsory (secondary) education may be more effective at fostering individual attainment than interventions that target young adults. Even though it is clear that mental health professionals and services must prioritize the mental health of all age groups, they should pay particular attention to individuals' developmental stages, as poor mental health during adolescence may be particularly disruptive and may lead to pivotal changes in educational trajectories.

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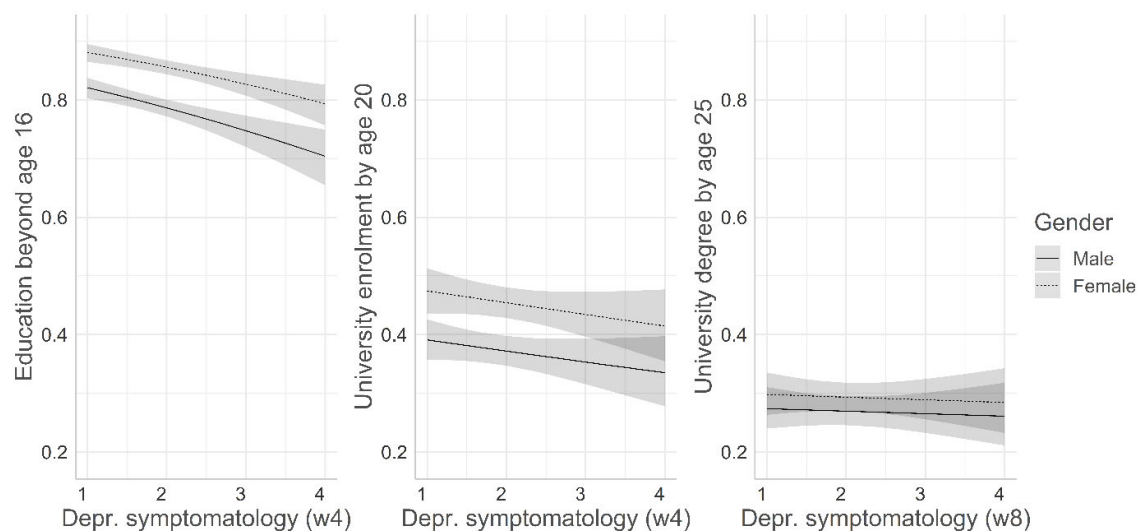
Figure 1

Predicted Probabilities of Educational Attainments at Age 17, 20, and 25, by Gender and Self-Esteem
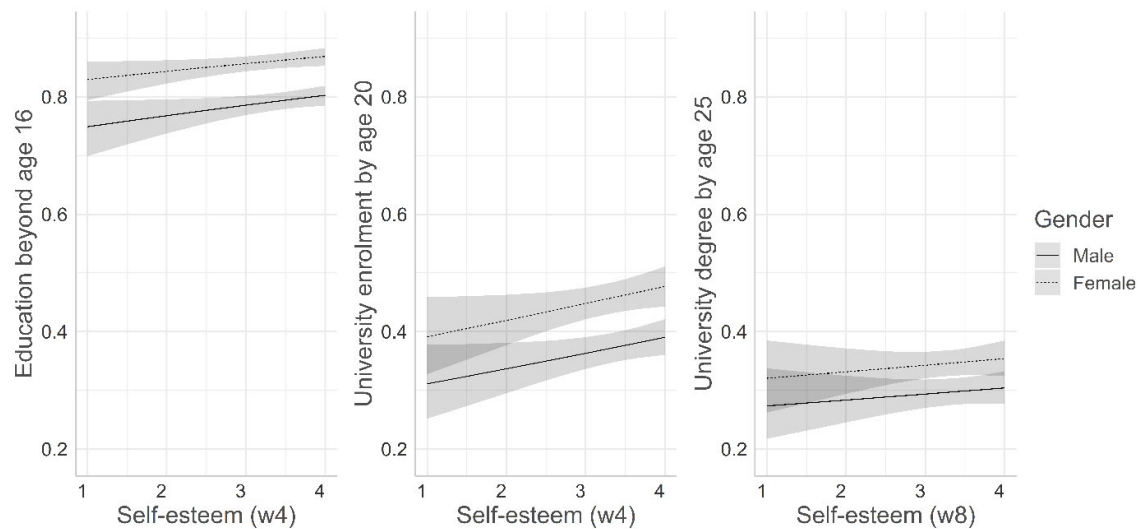
Note. Predicted probabilities of "continuing full-time education beyond age 16," "enrollment at university by age 20," and "university degree by age 25," as a function of gender and self-esteem. The analyses include all covariates. The analyses predicting university enrollment by age 20 and university degree by age 25 are based on the sample of young people who continued full-time education beyond age 16.

Figure 2

Predicted Probabilities of Educational Attainments at Age 17, 20, and 25, by Gender and Depressive Symptomatology

Note. Predicted probabilities of "continuing full-time education beyond age 16," "enrollment at university by age 20," and "university degree by age 25," as a function of gender and depressive symptomatology. The analyses include all covariates. The analyses predicting university enrollment by age 20 and university degree by age 25 are based on the sample of young people who continued full-time education beyond age 16.

Figure 3

Predicted Probabilities of Educational Attainments at Age 17, 20, and 25, by Gender and Perceived Stress
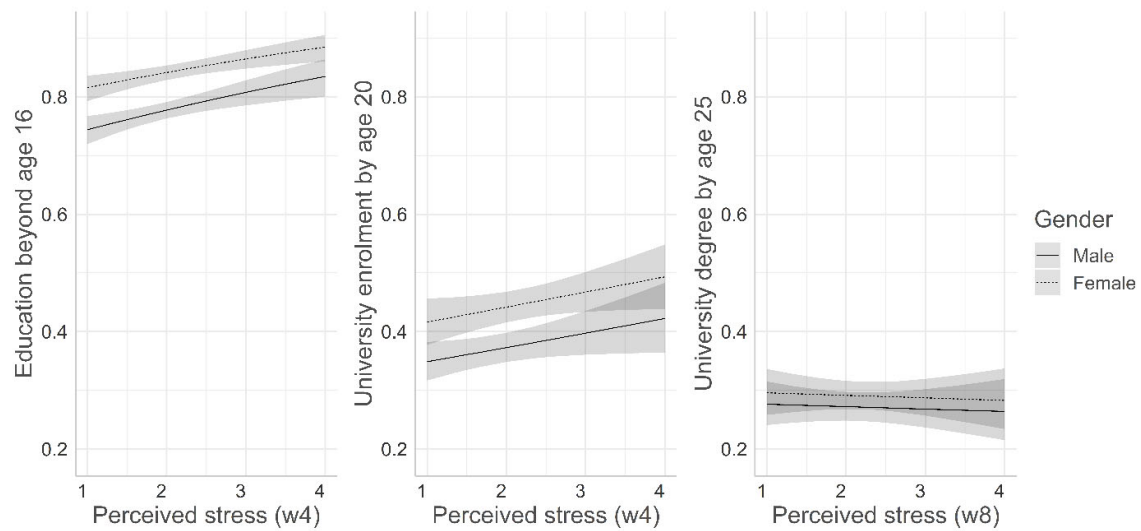
Note. Predicted probabilities of "continuing full-time education beyond age 16," "enrollment at university by age 20," and "university degree by age 25," as a function of gender and perceived stress. The analyses include all covariates. The analyses predicting university enrollment by age 20 and university degree by age 25 are based on the sample of young people who continued full-time education beyond age 16.

Table 1

Descriptive Statistics

Measures	Assessed in year	At age	Mean	SD	Min.	Max.	*N*
Female	2004	13/14	.48	---	0	1	15,594
Ethnic minority	2004	13/14	.33	---	0	1	15,573
Academic performance	2002	11/12	26.36	4.39	15	36	14,355
Parental education	2004	13/14	3.82	2.02	1	7	15,087
Parental social class	2004	13/14					12,694
Lower			.28	---	0	1	3'523
Intermediate			.34	---	0	1	4'316
Higher			.38	---	0	1	4'855
Household income	2004	13/14	3.04	1.41	1	5	11,621
Mental health in adolescence (wave 4)							
Self-esteem	2007	16/17	3.31	.63	1	4	11,136
Depressive symptomatology	2007	16/17	1.92	.62	1	4	11,137
Perceived stress	2007	16/17	2.02	.65	1	4	11,143
Mental health in young adulthood (wave 8)							
Self-esteem	2015-16	25/26	3.20	.65	1	4	7,299
Depressive symptomatology	2015-16	25/26	2.02	.61	1	4	7,297
Perceived stress	2015-16	25/26	2.14	.61	1	4	7,302
Educational attainments							
Continuing education beyond 16	2008	17/18	.79	---	0	1	11,278
Enrollment at university by age 20	2010	19/20	.49	---	0	1	8,493
University degree by 25	2015-16	25/26	.35	---	0	1	7,569

Note. *N* = number of observations. Academic performance was measured at key stage 2 (age 11). Parental education was assessed using an ordinal scale ranging from 1 (no qualification) to 7 (degree or equivalent). We report the mean score and standard deviation in the table; the mode of the scale is 4 = 'GCSE grades A-C or equivalent.'

Table 2

Zero-Order Correlations

	1	2	3	4	5a	5b	5c	6	7	8	9	10	11	12	13	14
2	.019*															
3	.058***	-.104***														
4	-.007	-.204***	.325***													
5a	-.002	.058***	-.233***	-.346***												
5b	-.018*	.029***	-.064***	-.116***	-.445***											
5c	.019*	-.082***	.276***	.435***	-.488***	-.565***										
6	-.012	-.226***	.296***	.393***	.438***	-.075***	.403***									
7	-.175***	-.009	-.037***	-.027**	-.011	.009	-.024*	-.012								
8	.170***	.040***	.094**	.037***	-.022*	-.010	.030**	.015	-.654***							
9	.195***	.023*	.221***	.105***	.079***	-.033**	.108***	.083***	-.516***	.612***						
10	-.088***	.049***	.044***	.030*	.035**	.007	.048***	.053***	.273***	-.223***	-.201***					
11	.040**	-.018	-.012	-.029*	.055***	-.012	-.037**	-.049***	-.200***	.213***	.199***	-.728***				
12	.113***	-.052***	.060***	.013	.011	-.024	.008	-.005	-.199***	.229***	.288***	-.600***	.686***			
13	.089***	.168***	.253***	.135***	.115***	-.058***	.145***	.118***	-.005	.007	.103***	.031*	-.011	-.001		
14	.079***	.156***	.431***	.206***	.186***	-.084***	.230***	.190***	-.014	.044***	.157***	.067***	-.036**	.002	.407***	
15	.027*	.027*	.337***	.196***	.169***	-.063***	.181***	.153***	.005	.036**	.119***	.057***	-.025*	.015	.293***	.542***

Note. 1 = Female; 2 = Ethnic minority; 3 = Academic performance (key stage 2); 4 = Parental education; 5a = Parental social class: lower; 5a = Parental social class: intermediate; 5a = Parental social class: higher; 6 = Household income; 7 = Self-esteem (w4); 8 = Depressive symptomatology (w4); 9 = Perceived stress (w4); 10 = Self-esteem (w8); 11 = Depressive symptomatology (w8); 12 = Perceived stress (w8); 13 = Continuing education beyond age 16; 14 = Enrollment at university by age 20; 15 = University degree by age 25. Pearson coefficients are reported for correlations between continuous variables, point-biserial coefficients when the correlation includes a dichotomous variable, and Phi coefficients when both variables are dichotomous.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 3

Odds Ratios from Logistic Regressions Predicting Educational Attainments at Age 17, 20, and 25, with Model Fit Indices

	Model 1 Continuing education beyond age 16		Model 2 Enrollment at university by age 20		Model 3 University degree by age 25		Model 4 (supplementary) University degree by age 25	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Female	0.71	0.18-2.83	1.00	0.23-4.41	0.38	0.12-1.23	0.94	0.15-5.79
Ethnic minority	4.02***	3.08-5.26	4.73***	3.76-5.94	2.95***	2.35-3.71	2.82***	2.24-3.55
Academic performance	1.14***	1.12-1.17	1.33***	1.30-1.36	1.27***	1.23-1.30	1.26***	1.23-1.30
Parental education	1.18***	1.14-1.23	1.18***	1.13-1.23	1.18***	1.12-1.25	1.17***	1.11-1.24
Parental social class (ref.: Intermediate)								
Lower	0.99	0.82-1.19	0.80*	0.65-0.99	0.86	0.66-1.11	0.84	0.64-1.09
Higher	1.31**	1.11-1.55	1.37***	1.15-1.62	1.16	0.96-1.39	1.15	0.96-1.38
Household income	1.08*	1.02-1.14	1.15***	1.08-1.22	1.10	1.03-1.18	1.10**	1.03-1.18
Mental health in adolescence *(wave 4)*								
Self-esteem	1.03	0.79-1.19	1.19	0.96-1.47			1.25	0.96-1.63
Depressive symptomatology	0.70**	0.56-0.88	0.80	0.63-1.01			0.90	0.66-1.24
Perceived stress	1.33**	1.08-1.65	1.42**	1.14-1.75			1.33*	1.03-1.72
Mental health in young *adulthood (wave 8)*								
Self-esteem					1.12	0.99-1.48		
Depressive symptomatology					0.99	0.83-1.21		
Perceived stress					0.86	0.69-1.08		
Interactions								
Female * self-esteem	1.25	0.95-1.65	1.08	0.81-1.44	1.27	1.00-1.58	1.06	0.74-1.51
Female * depressive sympt.	0.92	0.66-1.27	1.08	0.77-1.50	1.03	0.80-1.34	1.16	0.25-1.76
Female * perceived stress	1.16	0.87-1.55	0.98	0.73-1.32	1.18	0.92-1.51	0.90	0.63-1.28
Model fit indices								
Log likelihood	-3177.8		-2727.4		-2078.4		-2129.9	
AIC	6383.7		5482.9		4184.8		4287.8	
BIC	6479.1		5530.2		4272.3		4375.8	

Note. OR = odds ratio. CI = confidence interval. AIC = Akaike information criterion. BIC = Bayesian information criterion.

*** *p* < .001, ** *p* < .01, * *p* < .05.

SUPPLEMENTAL MATERIALS

Mental Health and Educational Attainment:

How Developmental Stage Matters

Supplemental Material A

To assess whether the mental health variables (self-esteem, depressive symptomatology, and perceived stress) were understood and measured equivalently over time, we tested for longitudinal measurement invariance for these variables. We followed the generally accepted approach of estimating a set of nested models that proceed from least to most restrictive (Meredith, 1993; Rutkowski & Svetina, 2014). First, we tested the mental health scales for configural invariance over time, assessing whether there was evidence of a qualitatively equivalent pattern of factor loadings, intercepts, and error variances over time. Second, we tested for metric invariance, assessing whether the pattern and values of the factor loadings were statistically equal over time. Third, we tested for scalar invariance, assessing whether, in addition, the intercepts were equal over time. Finally, we also tested for strict measurement invariance, that is, whether the factor loadings, intercepts, and error variances were equal over time. For model comparison, we applied the most common absolute measures of model fit (RMSEA, CFI, TLI, and SRMR), enabling the evaluation of goodness-of-fit independently of sample size. Model fit was considered acceptable when the following criteria were fulfilled: RMSEA < 0.08, CFI ≥ .0.90, TLI ≥ .0.90, SRMR < 0.08 (Hu & Bentler, 1999). Moreover, we evaluated changes in the model fit indices across models: RMSEA should increase by no more than 0.03 maximally between the configural and metric invariance models, and CFI should not decrease by more than 0.02. Between the models testing metric and scalar invariance, RMSEA should increase by no more than 0.01 maximally and CFI should decline by no more than 0.01 (Rutkowski & Svetina, 2014). Note that while strict invariance may be required as a condition for comparing latent means in some instances (Meredith, 1993), scalar invariance generally enables comparisons of manifest or latent variable means over time (Little, 1997; Thompson & Green, 2006).

Table A.1 summarizes the fit indices of the four models. The model testing configural invariance exhibited good model fit indices (Model 1). When we constrained the factor loadings to be equal over time (Model 2), the model fit indices remained good. This also held when we constrained the factor loadings and the intercepts to be equal over time (Model 3). The changes in the fit indices between these models were sufficiently small to provide support for metric and scalar invariance. Finally, even the model for strict measurement invariance, which constrained the loadings, intercepts, and error variances to be equal over time, exhibited acceptable fit (Model 4).

Table A.1
Longitudinal Measurement Invariance

Model	RMSEA	CFI	TLI	SRMR
1. Configural invariance over time	.050	.939	.923	.038
2. Metric invariance over time	.051	.934	.920	.050
3. Scalar invariance over time	.052	.928	.917	.053
4. Strict invariance over time	.054	.917	.910	.060

References

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Thompson, M. S., & Green, S. B. (2006). Evaluating between-group differences in latent variable means. In G. R. Hancock & R. O. Mueller (Eds.), *Structural equation modeling: A second course* (1st ed., pp. 119-169). Charlotte, NC: Information Age Publishing.

Supplemental Material B

Table B.1

Descriptive Statistics for the Entire Sample and for the Subsamples of Female and Male Respondents

Measures	Entire sample		Females		Males	
	Mean	SD	Mean	SD	Mean	SD
Female	.48	---	---	---	---	---
Ethnic minority	.33	---	.34	---	.32	---
Academic performance	26.36	4.39	26.11	4.53	26.63	4.21
Parental education	3.82	2.02	3.84	2.01	3.81	2.02
Parental social class	4.50	2.23	4.53	2.22	4.49	2.24
Lower	.28	---	.22	---	.23	---
Intermediate	.34	---	.31	---	.31	---
Higher	.38	---	.46	---	.46	---
Household income	3.04	1.41	3.05	1.41	3.02	1.42
Mental health in adolescence (wave 4)						
Self-esteem	3.31	.63	3.20	.67	3.42	.56
Depressive symptomatology	1.92	.62	2.01	.62	1.83	.56
Perceived stress	2.02	.65	2.16	.64	1.91	.58
Mental health in young adulthood (wave 8)						
Self-esteem	3.20	.65	3.14	.65	3.27	.63
Depressive symptomatology	2.02	.61	2.04	.60	1.99	.59
Perceived stress	2.14	.61	2.21	.59	2.08	.59
Educational attainments						
Continuing education beyond 16	.79	---	.83	---	.76	---
Enrollment at university by age 20	.49	---	.53	---	.45	---
University degree by 25	.35	---	.36	---	.33	---

Note. Academic performance was measured at key stage 2 (age 11). Parental education was assessed using an ordinal scale ranging from 1 (no qualification) to 7 (degree or equivalent). We report the mean score and standard deviation in the table; the mode of the scale is 4 (GCSE grades A-C or equivalent) in all three (sub-)samples.

Supplemental Material C

Table C.1

Results from Linear Probability Models Predicting Educational Attainments at Age 17, 20, and 25, with Model Fit Indices

	Model 1		Model 2		Model 3		Model 4 (supplementary)	
	Continuing education beyond age 16		Enrollment at university by age 20		University degree by age 25		University degree by age 25	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Female	-0.02	0.11	0.01	0.13	-0.18	0.11	-0.01	0.16
Ethnic minority	0.17***	0.01	0.26***	0.02	0.20***	0.02	0.19***	0.02
Academic performance	0.02***	0.00	0.05***	0.00	0.04***	0.00	0.04***	0.00
Parental education	0.03***	0.00	0.03***	0.00	0.03***	0.01	0.03***	0.01
Parental social class (ref.: Intermediate)								
Lower	-0.01	0.02	-0.03	0.02	-0.01	0.02	-0.02	0.02
Higher	0.03*	0.01	0.07***	0.02	0.04*	0.02	0.04*	0.02
Household income	0.01*	0.00	0.02***	0.01	0.02**	0.01	0.02**	0.01
Mental health in adolescence (wave 4)								
Self-esteem	0.01	0.02	0.03	0.02			0.04	0.02
Depressive symptomatology	-0.06**	0.02	-0.04*	0.02			-0.02	0.03
Perceived stress	0.06**	0.02	0.06**	0.02			0.05*	0.02
Mental health in young adulthood (wave 8)								
Self-esteem					0.03	0.02		
Depressive symptomatology					-0.00	0.02		
Perceived stress					-0.00	0.02		
Interactions								
Female * self-esteem	0.03	0.02	0.01	0.03	0.04	0.02	0.01	0.03
Female * depressive symptomatology	0.00	0.03	0.01	0.03	0.00	0.03	0.02	0.04
Female * perceived stress	-0.01	0.02	0.01	0.03	0.04	0.02	-0.01	0.03
Model fit indices								
Log likelihood	-3262.7		-2922.5		-2225.2		-2280.1	
AIC	6555.3		5875.0		4480.5		4590.2	
BIC	6657.9		5973.3		4574.3		4684.5	

Note. Coef. = coefficient. SE = standard error. AIC = Akaike information criterion. BIC = Bayesian information criterion.

*** $p < .001$, ** $p < .01$, * $p < .05$.